A BestPractices PUBLICATION ON IMPROVING INDUSTRIAL ENERGY EFFICIENCY

ENERGY MATTERS

Winter 2002

ISSUE FOCUS:
Smart Systems

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Augusta Newsprint Showcase, see insert.

INSERT:
OIT Showcase at Augusta Newsprint

OFFICE OF INDUSTRIAL TECHNOLOGIES •
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Fourth Round of Plant-Wide Assessments Could Improve Performance at Nine More Sites

In response to the fourth round of solicitations, nine industrial companies were recently named to receive cost-shared funding for plant-wide, energy efficiency opportunity assessments. Each plant has identified a team to help them conduct these assessments and identify potential areas for improvement.

The latest nine bring the total to 32 awards made by Oak Ridge National Laboratory (ORNL) since initiating the plant-wide assessment program in 1999. Of the 23 other plant-wide assessment sites, nine have completed projects for total estimated energy savings of 1 trillion Btu.

The companies submitted proposals through a competitive solicitation held in 2001. Each proposed a plan for a cost-shared assessment that could guide their plants to substantial energy and cost savings, improved productivity, reduced waste, and enhanced global competitiveness. ORNL will share up to half the cost, or up to $100,000, with each site to conduct the assessments, which will evaluate energy efficiency opportunities in areas such as:

- Electric motor systems
- Steam systems
- Compressed air systems
- Combined heat and power systems
- Process heating systems
- Process modifications
- Adoption of new emerging technologies

In addition to the cost-shared funding, each site will gain benefits such as national recognition and access to the whole range of the Office of Industrial Technologies (OIT) emerging technologies, tools, and resources.

Solicitations for the next round of plant-wide assessments will be announced on the OIT and BestPractices Web sites. Watch for announcements at **www.oit.doe.gov/bestpractices**. ●

Fourth Round Plant-Wide Assessment Awards Made by ORNL

Charter Steel, Saukville, Wisconsin, plans a plant-wide energy study focusing on process equipment, including plant utilities. The company will assess the impact of an emerging technology on energy savings and manufacturing costs.
Commonwealth Industries, Uhrichville, Ohio, will assess two aluminum sheet production operations (chill casting and continuous casting) and provide direct comparisons of energy requirements and future savings opportunities for the different process technologies.
Ford Motor Company, Cleveland, Ohio, will address the production process and will apply the principles of lean manufacturing to identify energy and cost reductions in the manufacturing operation.
Formosa Plastics, Port Comfort, Texas, and its partners will conduct a plant-wide study to develop and implement methods and strategies that address energy efficiency, waste reduction, productivity, and global competitiveness.
Georgia Pacific, Crossett, Arkansas, developed a plan to evaluate the plant as an integrated entity to achieve system-wide gains. The plant will use computer-modeling tools to verify mill data and perform system-wide optimization.
Jernberg Industries, Chicago, Illinois, will apply lean manufacturing principles and identify waste stream and productivity opportunities that can save energy.
North Star Steel, Wilton, Iowa, will focus on energy, waste, and productivity and will initiate a total assessment audit to identify opportunities in the manufacturing systems facility.
Pechiney Rolled Products, Ravenswood, West Virginia, intends to identify potential improvements in the aluminum casting and rolling mill. The company's key interest is to document efficiency improvements and develop energy accounting procedures to track and analyze plant equipment and practices.
Weyerhaeuser, New Bern, North Carolina, will apply an innovative systems approach to electrical load and efficiency for each key process and support system.

ENERGY MATTERS
is published quarterly by the U.S. Department of Energy's (DOE) Office of Industrial Technologies.

COMMENTS?

Contact:

Michelle Mallory,
Energy Matters Editor, at
303-275-3627, or e-mail
michelle_sosa-mallory@nrel.gov
1617 Cole Blvd., MS 1609
Golden, CO 80401

For address/subscription changes, please contact the editor.

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Weirton Steel and OIT Team Up to Save Millions

Many companies are feeling the heat of intense global competition, and Weirton Steel is no exception. But the company has fought back by partnering with OIT, developing an energy management plan, and upgrading its steel manufacturing plant in Weirton, West Virginia.

In 1996, the company commissioned a comprehensive energy management study of the facility, which provided the basis for an energy management control strategy. Central to this strategy was replacing the plant's antiquated utility control equipment with a "smart system" that allows plant managers to monitor and control utilities from one computerized center. The upgrade is ongoing, but so far, Weirton's investment of $16 million for this project has saved the company $18 million per year.

NREL/PIX 10699

Weirton Steel's new computerized controls respond rapidly to changing energy demands, enabling more efficient use of power and fuels.

Company Background

Headquartered in Weirton, West Virginia, Weirton Steel has been in business since 1910. It is the largest industrial employer in the state of West Virginia and the eighth-largest steel producer in the United States. Weirton Steel provides an extensive array of tin mill and sheet steel products as well as steel products for the building and construction market to customers all over the world. Weirton's products include high-quality galvanized steel that is purchased and used by manufacturers of steel framing for residential and commercial applications.

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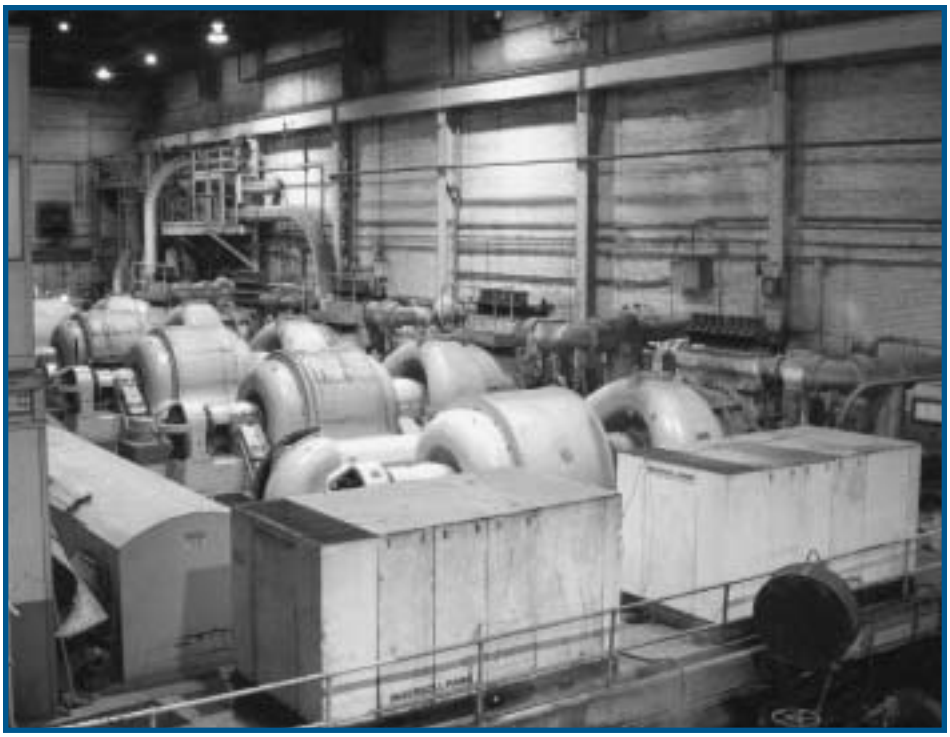

NREL/PIX 10701

Weirton Steel's turbine/generator floor in the powerhouse is monitored and controlled from the new central control room.

Weirton Steel and OIT Team Up

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Project Background

Weirton's first control system modernization project (Level I) replaced antiquated control equipment with a group of modern, state-of-the-art, computer-controlled systems monitored from a central room. The production processes at a steel plant are cyclical and dynamic, which creates constantly shifting energy demand patterns. The new controls modulate the various processes more rapidly, which allows a quicker response to changing energy demands, and enables more efficient use of power and fuels. In fact, the new controls have allowed the plant to use fewer generators, boilers, and blowers, plus capture and harness heat and steam to generate more steam and power.

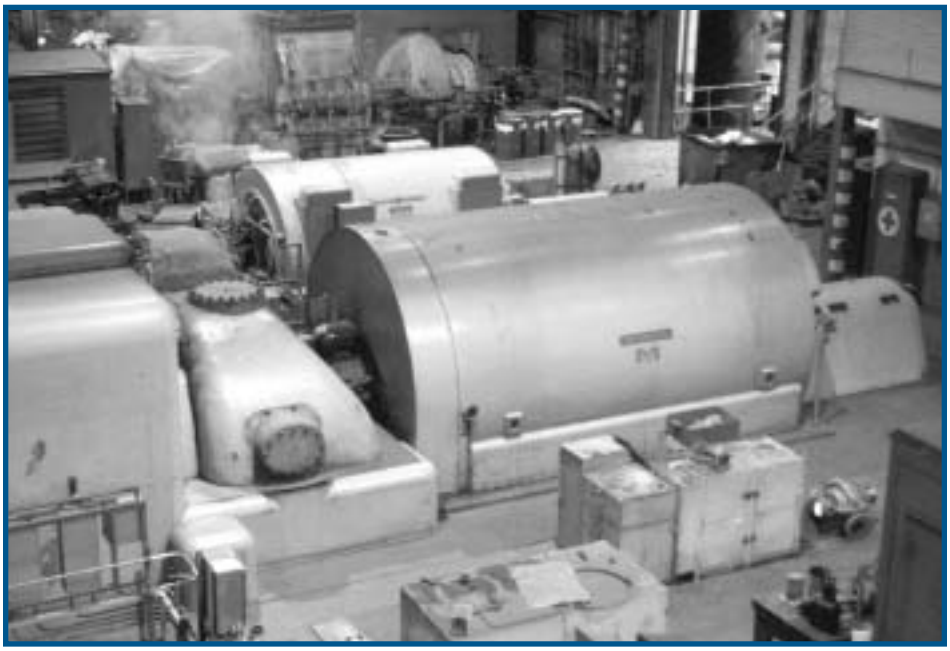
NREL/PIX 10698

This building houses Weirton Steel's utilities central control room.

For example, the production processes in the blast furnaces and the basic oxygen plants give off large quantities of blast furnace gas and waste steam. These byproducts can now be captured and used within the systems instead of being released into the atmosphere, which causes energy loss and pollution.

These improvements alone have resulted in a 30% gain in the efficient use of blast furnace gas and waste steam release and an 8% reduction in the amount of fuels needed, leading to $18 million in annual savings.

Howard Snyder, Weirton's technical director of operations, says that Level I "has dramatically streamlined the control strategy for our energy utilities."



NREL/PIX 10700

Operators regulate these turbine generators from Weirton's central control room.

Further Improvements Ahead

Weirton has plans to add a higher level of automation to leverage the existing system's statistical, technical reporting, and control capabilities.

"Level II will build on Level I by providing the tools to help operators make business decisions, based on past cost information," according to Snyder.

Weirton plans to start on Level II in 2002. The new project will engage a team made up of Asea Brown Boveri–Combustion Engineering (ABB-CE), Fisher/Rosemount, OIT, and West Virginia University. ABB-CE will conduct a technical evaluation of the operating practices, production rates, equipment capacities, and system control strategies. Then it will combine the evaluation data with process logic from diagnostic equipment to create the new system.

The new system will allow for real-time communication data flow between 22 different operating units. Weirton estimates that the project, with a capital cost of $570,000 will save $541,524 per year in purchased energy costs.

Applications

Your manufacturing facility could potentially save money and energy, and cut emissions by implementing a modern, computerized central-control system. Learn more about "smart" sensors and controls on the OIT Sensors and Controls home page at **www.oit.doe.gov/sens_cont/**. For more information on how OIT and the steel industry are collaborating to develop and implement technologies crucial to the industry's future, see the OIT Steel Industry of the Future home page at **www.oit.doe.gov/steel**. ●

Showcase Participation

Weirton has a history of partnering with OIT. In May of 2000, the company gave plant tours as part of the Pittsburgh Regional Technology Showcase, "A Celebration of the New Steel." The technologies that Weirton demonstrated included a basic oxygen furnace optical sensor, a galvanneal temperature measurement sensor, an infrared-based preheating system for strip metal, nickel aluminide radiant tubes, and nickel aluminide seal rolls. Read more in the showcase fact sheet at ***www.oit.doe.gov/factsheets/steel/pdfs/pittsburgh_steel_showcase.pdf****. Learn more about showcases on the BestPractices Web site at* ***www.oit.doe.gov/bestpractices*** *and in the special supplement of this issue.*

Combustion Control Strategies for Single and Dual Element Power Burners

By David C. Farthing, Federal Corporation, Oklahoma City, OK

Today's economic and environmental demands dictate that we get the greatest practical efficiencies from our plants. To do this we must have a basic understanding of what those efficiencies are and how to implement them.

New technology improves overall combustion efficiency and burner stability when loads and demands are variable.

Advanced automatic systems for combustion control are excellent methods for improving systems and process automation success. New technology available today helps improve overall combustion efficiency and burner stability when loads and demands are variable. The most sophisticated systems can eliminate the need for operator input during load changes while maintaining safe and reliable fuel/air ratios.

This discussion describes several systems, from the simplest to the most elegant, and focuses on the features, benefits and applications of several systems applied to single-burner packaged boilers.

A Look at Combustion Strategies

Here are some control strategies to consider for improving burner efficiency. The right strategy depends on boiler loads, demands—and economics.

Fixed Position Parallel Controls. The simplest form of combustion control for power burners is the fixed position parallel control (FPC) (Figure 1)—also known as direct or jack-shaft control. This strategy incorporates a single positioning motor, which drives both the fuel and air positioning devices via an interconnected single mechanical link, the jack-shaft.

The simplicity of the FPC control strategy makes it a very economical choice for small burners with modest firing rate changes. However, because fuel and air are fixed, the fuel/air ratio is also fixed. The burner cannot compensate for environmental changes, such as combustion air temperature or fuel pressure. Additionally, the FPC strategy lacks feedback to the control element, which can cause fuel to cross over the airflow and cause a fuel-rich furnace or other burner efficiency losses.

To help prevent a fuel-rich furnace, FPC systems are set to allow 4% to 8% excess oxygen to the furnace. In practice, the excess oxygen is normally set at 6% to 7%, allowing for seasonal air temperature changes.

Parallel Positioning Control Systems. These systems function similarly to FPC systems, except that fuel and air end-devices are separated and driven by individual positioners. Modern electronic parallel positioning controls (PPC) incorporate end-device positioning signals to ensure accurate placement of fuel and air positioners for specific firing rates. These signals make PPC systems much improved over FPC systems.

The new systems are gaining acceptance over FPC systems because they offer an economical means to improve overall combustion efficiency. PPC systems are suitable for 100 to 900 boiler horsepower (Bhp) boilers that operate with relatively stable loads. Larger systems are also becoming more prevalent.

PPC systems can hold excess oxygen levels to within 3% to 4% in many applications, but because they lack true process variable feedback in the fuel/air systems, they should be used cautiously in applications with extremely fast load swings. Like FPC systems, PPC systems cannot compensate for changes in fuel or combustion air characteristics.

Series Metered Control Systems. Boilers larger than 750 Bhp commonly incorporate series metered control (SMC) systems, where load changes are neither large nor frequent. In this application, both fuel and air are metered. The boiler master controller regulates combustion airflow with a set point. The airflow controller cascades the airflow signal to the fuel controller as its remote set point. A ratio algorithm signal sent to the fuel controller adjusts the fuel/air ratio.

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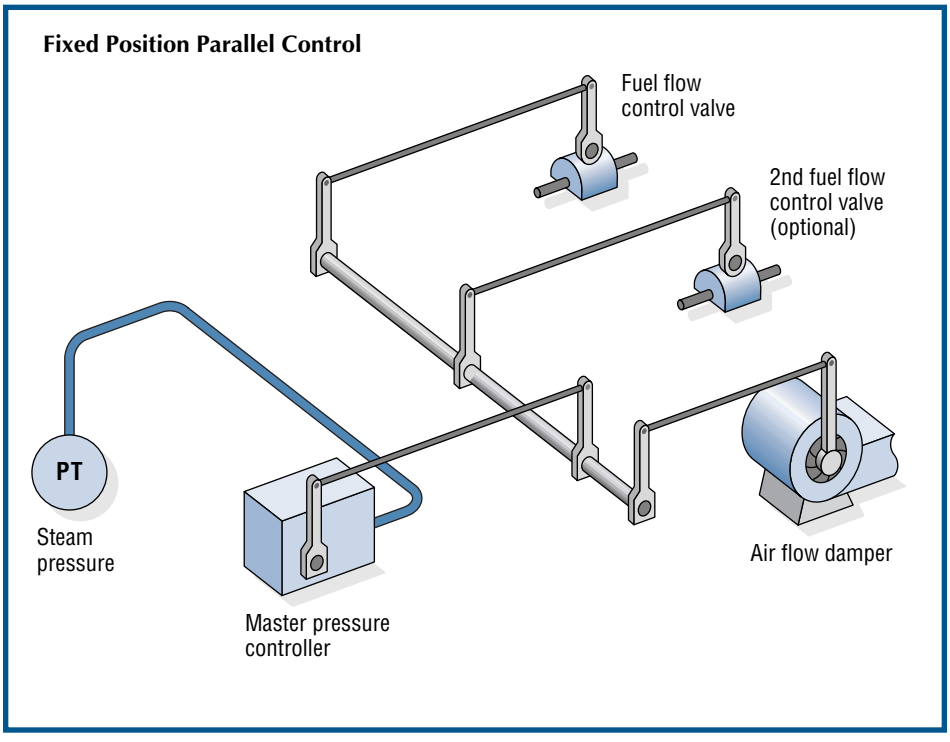

Figure 1. Fixed position parallel jack-shaft combustion system with fuel/air ratio established through fixed mechanical linkages.

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This ratio algorithm has an inherent lag because the air controller directs the fuel controller's function. This lag provides a desirable lean furnace on demand rise. However, on a fast falling demand, the lag between the air and fuel controllers can cause a fuel-rich furnace.

Because of the lag on a falling demand, the SMC is only adequate for near steady-state conditions. Excess oxygen levels are usually set at 5% to 8%; however, by using an oxygen trim system, levels can be adjusted to 3% to 4% during steady-state operation.

Metered Parallel Positioning Control Systems. Boilers operating at 1,000 Bhp or higher may incorporate metered parallel positioning control (MPPC) systems. These operate the fuel and air control loops in parallel from a single setpoint generated by the boiler master controller. A combustion air set point ratio establishes the fuel/air proportions.

This fuel/air customization feature means excess oxygen in the exhaust gases may be reduced to 3% to 4%. To maintain an air-rich furnace on transition, MPPC systems are normally set with additional excess air to compensate for fuel flow during setpoint excursions. In practice, the excess air is set at 4.5% to 5% to compensate for barometric changes in air density. During steady-state operation, this can be adjusted to 2.5% to 3% using an oxygen trim system.

Like the series system, the traditional MPPC system lacks feedback to the opposing flow controllers, which can result in combustion imbalance on large or very fast load swings. These systems require nearly identical responses from both the air and fuel control loops to prevent fuel or air-rich mixtures in the furnace. This limits the MPPC system to boilers with modest demand swings.

Cross-Limited Parallel Metered Control Systems. This strategy improves on MPPC by interlocking fuel/air ratio control to prevent a fuel-rich furnace. The cross-limited control (CLC), or lead-lag control (Figure 2), is dynamic and easily adjusts to different response times of the fuel and air end devices. This flexibility allows its use in systems with sudden and large load swings and provides precise combustion control at steady-state operation.

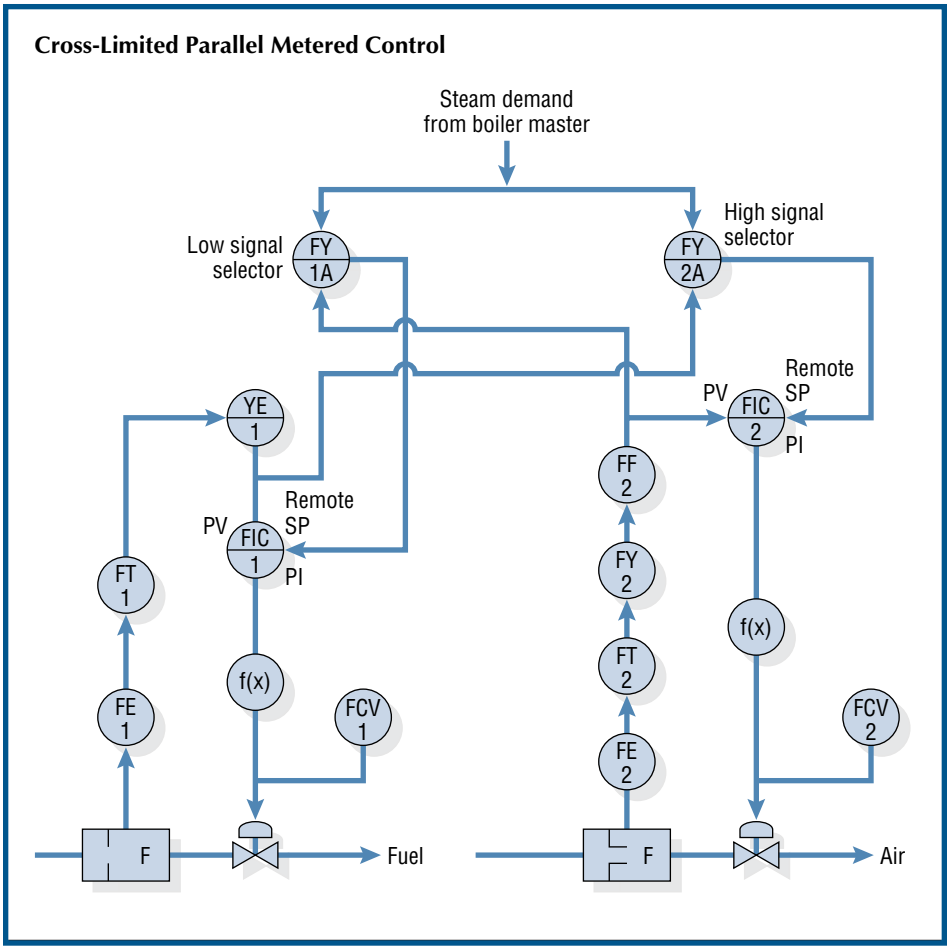

Figure 2. Cross limiting, or lead-lag fuel/air ratio control, is the most dynamic of all combustion control strategies.

CLC systems easily maintain excess oxygen levels at 3% to 4% in gas burners and 2.5% to 3% in #2 oil systems. Additionally, the cross-limiting feature prevents fuel from overshooting airflow.

Because of its capability for close tolerance control, CLC systems are suited for all sizes of boilers that can support the systems installation cost. Additionally, the CLC system can be readily adapted to oxygen trim control and is suitable for most low-NO_x burner applications.

Selecting a Strategy

The economic balance between fuel cost, safety, boiler load, and control system cost will eventually determine which of these systems best suits your process. However, in practice, the use of parallel positioning systems on boilers up to 900 hp is usually the most economical. Cross-limited systems are typically used in critical load applications of 1,000 hp and higher. ●

David Farthing has 28 years of experience in thermal processes. He is both a practitioner and an academic in the field of boilers and thermal process control systems, as Sales Manager for Federal Corporation and adjunct instructor at Oklahoma State University. Contact him at dfarthing@federalcorp.com or 405-239-7301. The full version of this paper is available on Energy Matters Extra at ***www.oit.doe.gov/bestpractices/energymatters/emextra****.*

Compressed Air System Optimization Improves Production at Metal Forging Plant

For Modern Forge of Tennessee, adding a new air compressor at first seemed to be the solution for meeting the pressure level requirements of its end-use applications. However, a system-level survey revealed several opportunities to optimize the existing five compressors—and that proved to be a better solution than purchasing a sixth compressor.

By implementing improvements across the compressed air system, Modern Forge now requires fewer compressors, has improved product quality, and has increased productivity. With energy cost savings of $120,000, or 2.4 million kWh annually, the plant has reduced its total electricity costs by 8%. The company saves another $40,000 per year in maintenance costs and has avoided a $120,000 capital investment to purchase a new air compressor. At a cost of $105,000 the payback on the project was just 8 months.

The plant, located in Piney Flats, Tennessee, is a subsidiary of Modern Drop Forge Company. Its 235 employees manufacture forged metal components for the mining and construction industries, automotive suspensions and transmissions, motorcycle frames, plus hand and specialty tools. Compressed air is important in the plant's production process because it directly supports grinding, pressing, and die forging.

Before the project, the plant had to operate all five compressors, totaling 2,000 hp, to maintain a minimum system pressure of 100 psig. Each compressor's discharge pressure ranged from 120 to 125 psig to account for pressure drop of 20 to 25 psig. This wasted energy and meant frequent maintenance.

Survey Identifies Inefficiencies

Modern Forge called on Compressed Air Management, a BestPractices Allied Partner, to evaluate the system. The survey found two main sources that prevented the plant's compressed air system from maintaining a stable pressure level.

- A lack of storage meant the plant had to run compressors even when demand was low or nonexistent. Compressed air was being wasted, but this was the only way to meet the minimum 100-psig air requirements in the forge shop, the most important air application in the plant.
- Excessive pressure drop was caused in part by the intermittent demand from the forge shop, and exacerbated by poorly engineered point-of-use components and dirty filtration devices. In addition, the piping system in the forging shop was partitioned by closed isolation valves in the header, which increased the pressure gradient in that part of the plant.

Modern Forge of Tennessee evaluated its compressed air system, and then implemented several changes to optimize the system.

Modern Forge also discovered that the antiquated compressor controls lacked enough control points to gauge air demand and properly sequence the compressors. This caused the compressors to work against each other and made the control system inefficient and unreliable.

Furthermore, the survey revealed that the system was leaking air at a rate of about 20% of its output and had a problem with lubricant and moisture carryover. Finally, the 200-hp compressor used on weekends for packaging and support operations was oversized for these applications.

Storage, along with pressure/flow controllers, have stabilized Modern Forge's compressed air system.

System-Level Fixes

After considering the survey recommendations, Modern Forge realized that implementing system-level modifications would yield better results than simply adding another compressor.

The plant took action by:

- Adding two receivers to provide 7,500 gallons of storage.
- Modifying the piping distribution system and opening the valves in the forge shop header.
- Replacing the run/modulation sequencer with a programmable logic control (PLC) system to centralize control of all five compressors, maintain adequate pressure differentials, and sequence them more effectively. The system was linked to the pressure/flow controllers to obtain accurate air demand signals.
- Installing pressure/flow controllers in the forge and die shops to stabilize header pressure as required in each area.
- Purchasing and installing a dedicated 40-hp compressor for weekend packaging operations and some die shop functions.
- Installing another dryer and replacing filters.
- Implementing a leak detection/repair campaign that includes replacing worn point-of-use components and training personnel.

Benefits of an Optimized System

Once the project was completed, the system began to function more efficiently. The pressure/flow controllers stabilized the pressure levels, diminishing the pressure drop that had previously plagued the system. Opening the isolation valves in the forge shop header spread the load across all of the compressors and reduced the pressure gradient.

The new PLC control system responds quickly and accurately to air demand patterns and allows the system to operate with

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Compressed Air System Optimization

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fewer compressors. Instead of having to operate 2,000 hp worth of compressor capacity, the plant only requires between 650 and 1,100 hp, depending on demand.

The new controls also eliminated lubricant carryover by preventing frequent loading and unloading of the rotary screw compressors. Thanks to more consistent and lubricant-free air, product quality has improved and the plant has reduced production rejects. In addition, the forging hammers are more productive.

Modern Forge's leak detection and repair operation omitted the largest leaks in the system, including those at the point-of-use components (regulators, filters, and hoses) and reduced air lost to leaks by 10%. Meanwhile, the additional dryer, new filtration equipment, and the pneumatic condensate drains eliminated problems from moisture carryover.

Finally, the training sessions have helped plant personnel make better use of the system. Now that they are more informed, personnel operate compressors at lower pressure levels than before.

Smart Controls for Multiple Compressor Systems

Modern Forge took an important step by upgrading its compressor control system. This might be an approach for other plants to consider as part of an overall strategy for improving compressed air system efficiency. In the past, industrial plants have relied on cascading set points to control multiple compressor systems. With this approach, the plant established individual operating pressure set points to either add or subtract compressors to meet air demand.

Today, however, new control strategies can control multiple compressors with single set point logic. The most sophisticated of these strategies, system controls, coordinate compressor operation regardless of type or make. Individual compressor controls, linked together, respond quickly to changes in air demand patterns. All compressors operate within a single pressure band in a sequence tailored to maintain system pressure within specific limits and in the most cost-effective manner. Compressors brought online as system pressure begins to decay become fully operational before the pressure falls below production's minimum requirements.

Learn more about applying compressed air system controls in the Compressed Air Challenge's Improving Compressed Air System Performance *sourcebook's "Fact Sheet #6" available on the BestPractices Web site at* ***www.doe.gov/bestpractices/compressed_air/****. Also check the BestPractices training page at* ***www.oit.doe.gov/bestpractices/training*** *for opportunities to learn more about managing your plant's compressed air system.*

Lessons Learned

When a compressed air system does not deliver as required, a complete system evaluation could provide valuable answers. In Modern Forge's case, an evaluation led to improvements that allow the system to perform to its full potential and averted the need for another compressor. In addition, Modern Forge has realized the benefits of reduced energy use, energy and maintenance cost savings, and improved productivity. ●

Ask the Clearinghouse

Variable Speed Drive Part-Load Efficiency

This column highlights key questions from industrial customers to the OIT Clearinghouse. Through the OIT Clearinghouse, you can access the full portfolio of OIT resources and get technical advice about motor, steam, compressed air, combined heat and power, and process heating systems.

Clearinghouse engineers and technical staff expertly answer industrial efficiency questions, 11 hours a day, Monday through Friday. The Clearinghouse also has access to industry experts around the country. Call the OIT Clearinghouse at 800-862-2086, or go to **www.oit.doe.gov/clearinghouse/**.

Q: What is the efficiency of a variable speed drive when it is operating at reduced speeds?

A: One manufacturer provides efficiency values for pulse-width modulated variable frequency drives (VFDs) as a function of operating speed for both variable torque loads (centrifugal fans and pumps) and constant torque loads (cranes, hoists). Remember that, according to the affinity laws for variable torque loads, the driven-equipment horsepower requirement varies as the cube or third power of the operating speed ratio. For constant torque loads, the horsepower required varies linearly with rotating equipment speed.

Power Requirement for Centrifugal Loads

$$hp_2 = hp_1 \times (RPM_2)^3 / (RPM_1)^3$$

Where:

hp_1 = driven-equipment horsepower requirement at original operating speed

hp_2 = driven-equipment horsepower requirement at reduced speed

RPM_1 = original speed of driven equipment, in revolutions per minute (RPM).

RPM_2 = reduced speed of driven equipment, in RPM

The table (at right) provides efficiency values for VFDs of various horsepower ratings when serving motors connected to variable torque loads.

It is apparent that efficiency decreases with decreasing load, and that the decline in efficiency is more pronounced with drives of smaller horsepower ratings. This reduction in efficiency is not as detrimental as it first seems, however. Consider a variable speed drive coupled to a motor that delivers 5 hp to an exhaust fan. When the fan is operated at 25% of its rated speed, the drive efficiency is 29.6%. At ¼ of its rated operated speed, the fan delivers 25% of its rated airflow, but requires only 1/64th of its full-load power. Even with the low drive efficiency, with variable speed operation the power required by the fan is reduced from 5 hp to 0.26 hp (1/64 x 5 hp/ 0.296). ●

VFD Efficiency (in Percent) as a Function of Percentage of Full Operating Speed

Variable Speed Drive hp Rating	Percent of Full Operating Speed			
	25%	50%	75%	100%
1	9.4%	44.2%	70.5%	82.5%
5	29.6%	74.7%	88.3%	92.4%
10	35.3%	79.0%	90.3%	93.5%
25	35.6%	79.4%	90.6%	93.8%
50	43.3%	83.5%	92.1%	94.4%
100	54.8%	89.1%	95.0%	96.6%
250	61.2%	91.3%	96.1%	97.3%

These values are provided by a VFD manufacturer. There is no widely accepted test protocol that allows for efficiency comparisons between different drive models or brands. An inverter can be set up many ways and that can affect operating efficiency.

What's the Right Level of Automation?

By David Berger, Contributing Editor,
Plant Services Magazine

To automate or not to automate, that is the question. Finding the answer requires evaluating a number of cost/benefit factors, including cash flow, organizational readiness, ease of implementation, availability of resources, technological maturity and availability, and probability of success.

Cost/Benefit. Top of mind for most senior managers is finding some way to sort out the never-ending stream of requests for what appears to be worthy automation projects. In many cases, this includes structuring the business case in a standardized format, which allows senior management to compare apples to apples.

Evaluate cost/benefit factors to find the right level of automation for your plant.

Hard Savings. These include items such as reduced headcounts, increased production volume and improved product quality. Hard savings are then compared to the hard costs associated with attaining the benefits, using standard financial ratios. But how hard is hard? True hard savings can be difficult to determine. Implementing a management information system (MIS) that monitors various measures does not automatically guarantee cost savings. If management is unwilling or unable to take timely and appropriate action, or if the source data is inaccurate, then hard savings will be unattainable.

Soft Savings. In most circumstances, hard benefits are more of a priority than soft, which have no direct and indisputable impact on the bottom line. Occasionally, companies go through periods when certain soft benefits are all the rage. Savvy middle managers incorporate these trends into their requests for automation.

Cash Flow. Another critical factor is how much cash is available. A company is far more likely to forego automating its MIS, where savings are longer term and less tangible, if the company is downsizing, is in a high growth mode, or is heavily in debt. Such tradeoffs are commonplace. This is one reason why joint ventures, outsourcing, and application service providers are gaining in popularity.

Organizational Readiness. Companies that have attempted to implement an identical automation program in multiple plants understand the huge differences regarding organizational readiness that can exist. If the people are not willing or able to make the project work, then there is little question as to what the end result will be. This is especially true when implementing a new or upgraded MIS, because it requires accurate data entry, definitive decision-making, and action.

Ease of Implementation. When weighing the pros and cons, one key consideration is ease of implementation. Any automation project that looks like it will drag on longer than 3 to 6 months will be less likely to gain approval from top management. Middle managers are well advised to break a larger project into smaller, easily implemented work packages, which show the cost/benefit for each piece.

Availability of Resources. Every company has limited resources and must, therefore, strike a balance between running the business of today and building the business of tomorrow. Automation projects are less likely to be approved if they require too many good people already burdened with line responsibilities or other worthy projects. This is another reason to divide an automation project into more manageable pieces or seek help from outside business partners.

Technological Maturity and Availability. Higher risk may bring greater reward, but it may also result in greater losses. If the technology is "bleeding" edge, then top management is less likely to approve the business case, no matter how great the reward may seem. Even if the technology is proven in other industries, it may not be applicable or available to your industry.

Probability of Success. Last, but by no means least, is the likelihood of successfully sustaining a given level of plant automation over the short and long term. Projects with a higher return but lower probability of success are severely discounted in the eyes of senior management. When preparing the business case for automation, make sure you address the critical success factors, as well as how you intend to overcome potential barriers to success. ●

This article is excerpted with permission from Plant Services Magazine, *©Putman Media 2001. The original appeared in the August 2001 issue and is available on Energy Matters Extra at* ***www.oit.doe.gov/bestpractices/energymatters/emextra.***

Collaboration Advances Motor Efficiency

Industrial electric motor systems consume large amounts of energy—roughly 23% of all electricity sold in the United States. And that comes with a price. Energy represents more than 97% of total motor operating costs. In large industrial plants, motor system energy costs can easily exceed $1 million annually. However, by installing energy efficient motors and applying good motor systems management techniques, a company can reduce its motor systems energy costs by as much as 18%.

These facts have prompted the National Electrical Manufacturers Association (NEMA) and its motor and generator member companies to join forces with the Electrical Apparatus and Service Association (EASA), the Consortium for Energy Efficiency (CEE), the Copper Development Association, DOE, and several other organizations to initiate the Motor Decisions Matter campaign. Facilitated by the CEE, the nationwide campaign encourages sound motor management and planning as a tool for cutting motor system energy costs and increasing energy efficiency. In doing so, industrial customers can help increase the reliability and quality of motor-driven process systems and reduce plant operating costs.

The campaign targets three key audiences: executive level managers; maintenance repair and operation employees, plant managers, and engineers; and distributors and repair firms. To help them develop a sound motor plan, the campaign offers an online Motor Planning Kit. With a proactive plan, industrial motor users can be better prepared to make sound decisions regarding the repair or replacement of a motor in the event it fails.

Working to Promote Motor Efficiency

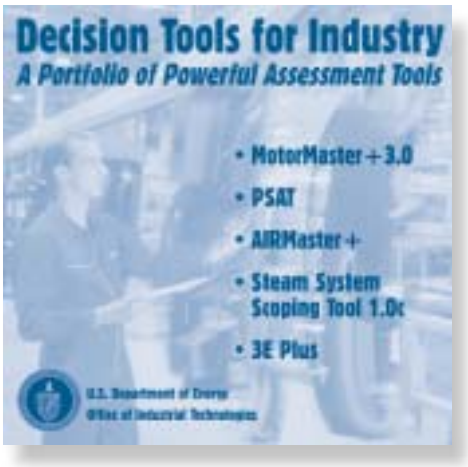
Motor Decisions Matter encourages the use of energy-efficient motors and motor systems as part of an overall approach to energy management. DOE has partnered with several of the campaign sponsors.

NEMA and DOE have worked together to promote efficient industrial motor systems since 1993, when NEMA signed on as a "Charter Partner" in the former DOE Motor Challenge Program. DOE continues to work closely with NEMA to promote NEMA Premium™ and motor system efficiency. EASA was the first Motor Challenge Allied Partner and has been very active in educational efforts and has worked to develop guidelines for motor repair.

In addition, the Copper Development Association, also a long-time Allied Partner, has helped to promote efficient motors and distribute DOE's MotorMaster+ software. DOE has also worked with several of the CEE member utilities and sponsor organizations.

Learn more about Motor Decisions Matter and find a listing of sponsors by visiting the Web site at **www.motorsmatter.org**. For more about publications, software tools, and training information specific to motor systems, log onto OIT's BestPractices Web site at **www.oit.doe.gov/bestpractices/motors/**. ●

Upgraded Tools CD Helps Assess and Improve Energy Management Systems



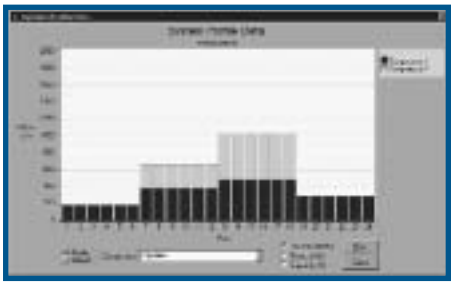
Boost your systems' productivity and reliability, and save your company money with OIT's newest release of the *Decision Tools for Industry* CD. This portfolio of powerful system assessment tools now includes two new software programs: AIRMaster+ and 3E Plus.

- AIRMaster+ is a comprehensive, air system energy management program that enables auditors to assess compressed air systems, model existing and future system upgrades, and evaluate the energy savings and cost-effectiveness of energy efficiency measures.
- 3E Plus helps determine if boiler systems can be optimized by insulating boiler steam lines. It calculates the most economical thickness of industrial insulation for a variety of operating conditions using either the built-in thermal performance relationships of generic insulation materials or conductivity data for other materials.

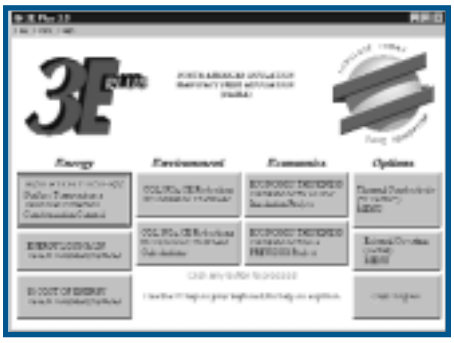
The CD also includes the current versions of other OIT industrial assessment tools, such as MotorMaster+ 3.0, the Pumping System Assessment Tool (PSAT), and the Steam System Scoping Tool.

- MotorMaster+ 3.0 helps you find out when to replace versus repair, and what motors to buy.
- The Pumping System Assessment Tool (PSAT) assists you in assessing pumping efficiency and calculating energy savings.
- The Steam System Scoping Tool compares your steam system to best practices in industry.

Order your free copy of this CD now by logging on to the BestPractices Software Tools Web site at **www.oit.doe.gov/bestpractices/software_tools.shtml**, or by calling the OIT Clearinghouse at 800-862-2086. ●



OIT's Decision Tools CD now includes AIRMaster+ to help you evaluate compressed air efficiency.



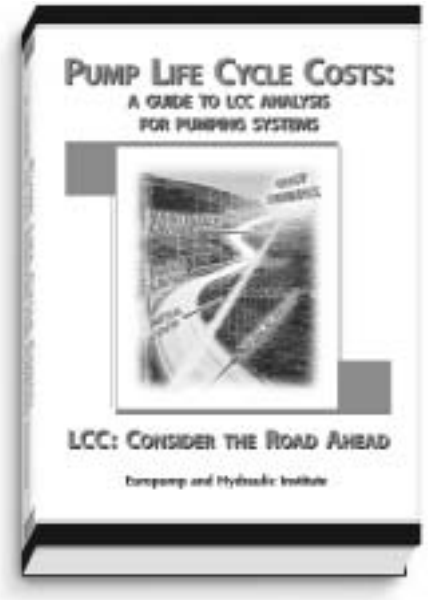
With 3E Plus, you can calculate the most economical thickness of industrial insulation.

Life Cycle Cost Analysis: A Management Tool for Pump System Efficiency

Pumping systems account for nearly 20% of the world's energy demand and, in some industrial operations, account for 20% to 50% of energy costs. However, because pumps function as a component of larger systems, companies may overlook opportunities for savings and improved pump system performance.

Life Cycle Cost (LCC) analysis is a management tool that can help companies minimize waste and maximize energy efficiency for many types of systems, including pumping systems. In cooperation with DOE, the Hydraulic Institute (an OIT Allied Partner), and Europump, have developed *Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems.* A free executive summary offers highlights of the larger 200-page guide, assisting plant owners and operators in applying the LCC methodology to pumping systems. Use the guide to identify opportunities for considerable cost and energy savings.

Learn more about applying LCC methods to pumping systems by downloading the summary from the "Energy Savings" section of the Hydraulic Institute Web site at **www.pumps.org**, or from the BestPractices Web site at **www.oit.doe.gov/bestpractices/technical_publications.shtml#pumplifecycle**. The 200-page *LCC Guide* is available for purchase from the Hydraulic Institute at **www.pumps.org**. ●



AIRMaster+ and Qualified Specialist Training

If you analyze your company's industrial compressed air system, AIRMaster+ could be the right tool to assess energy savings opportunities. AIRMaster+, available through OIT, is a Windows-based tool that models existing and future system operation and evaluates the potential impact of energy-saving measures. Users of AIRMaster+ include compressed air equipment companies and distributors, system auditors, plant personnel, and utility representatives. AIRMaster+ can help improve your compressed air system—and help save your company money.

DOE and the Compressed Air Challenge® (CAC) offer AIRMaster+ training to help system experts make the most efficient use of the tool and maximize its benefits. During the course, participants learn:

- How to use the AIRMaster+ software
- How to accurately acquire input data for AIRMaster+
- How to use the software to evaluate compressed air systems and develop a measurement plan
- How to make measurements for hourly trends of typical daily data versus dynamic measurements to characterize system events, pressure, and flow profiles
- How to create AIRMaster+ compressor operating scenarios and account for the effect of system dynamics, pressure profiles, flow versus pressure characteristics, and compressor control operation

The 2½-day program includes classroom instruction, a practical exam to test hands-on measurement, and a written exam. Learn the software methodology, how to collect and enter field data, and how to interpret results.

How to Become a Qualified Specialist

OIT Allied Partners who take the training and pass the exam can become Qualified AIRMaster+ Specialists. These Specialists can better help you to identify savings opportunities in your plant using AIRMaster+. DOE and CAC recognize Qualified AIRMaster+ Specialists for their ability to use the AIRMaster+ software effectively with industrial end users.

To become a Qualified AIRMaster+ Specialist, Allied Partners must complete the CAC Advanced Management of Compressed Air Systems course as a prerequisite to the AIRMaster+ training.

Find the list of Qualified AIRMaster+ Specialists on the BestPractices Web site at **www.oit.doe.gov/bestpractices/software/airmaster_cert/shtml**. If you are a compressed air system expert interested in the AIRMaster+ qualification process, please contact Aimee McKane at atmckane@lbl.gov. Order a copy of AIRMaster+ from the OIT Clearinghouse at **www.oit.doe.gov/clearinghouse**, or call 800-862-2086. ●

Qualified Specialists for Pumping System Tool

Don't forget that Pumping System Assessment Tool (PSAT) Qualified Specialists are also available to help you. Demand for training has grown, and DOE has responded by training more experts in the PSAT software. With a little instruction from a specialist on using the software, you can put PSAT to the test and begin uncovering the pump system savings waiting in your plant. Locate a PSAT Specialist on the BestPractices Web site at ***www.oit.doe.gov/bestpractices/software/psat_cert.shtml****.*

If you are a pump system professional interested in the PSAT qualification process, please contact Vestal Tutterow at vctutterow@lbl.gov.

Second Energy Solutions for California Event Held in San Jose

In partnership with the California Energy Commission, the OIT is hosting a series of 1-day events to assist California industries in improving system efficiency and reducing electrical demand. The second of these events took place on January 16, 2002 at the San Jose Convention Center in San Jose, California. Keynote speaker for the event was Speaker pro Tem Fred Keeley (D-Boulder Creek), who addressed "The Future of Energy Efficiency in a Post Energy Crisis World." Co-sponsoring organizations included the Silicon Valley Manufacturing Group, California Manufacturers and Technology Association, California League of Food Processors, and the Association of California Water Agencies.

Nearly 200 participated in the event, including 103 attendees and 68 representatives from OIT Allied Partner companies. Of the 31 exhibitors, 28 booths were represented by Allied Partners. In addition, speakers offered practical advice and solutions for managing electrical demand and improving system efficiency. Case studies of California industries illustrated how a systems approach can help companies reduce electrical energy usage.

The third Energy Solutions for California event will be May 15, 2002, at the West Coast Anaheim Hotel in Anaheim. For more information about the upcoming event and a complete list of participants and case studies from the San Jose event, visit **www.projectperformance.net/caenergyevents**. ●

Improved Compressor Performance Information Now Available

The Compressed Air and Gas Institute (CAGI), a trade association representing compressed air equipment manufacturers, has worked with its member companies to develop standardized performance testing for compressors and compressed air dryers. As a result, data sheets are now available that will help end users select compressed air system equipment suitable for the planned operating conditions.

In its 1997 Allied Partner agreement, CAGI made a commitment to standardize testing and develop data sheets. Compressed air equipment manufacturers are responsible for providing the self-certified data that completes the data sheets. Purchasers can use these data sheets to compare like equipment under equal operating parameters. The standardized data sheet formats for rotary screw and reciprocating compressors as well as refrigerant and regenerative desiccant dryers can be found at **www.cagi.org/intro.htm**.

Kaeser Compressors, a CAGI member and an OIT Allied Partner since May 2001, is the first compressed air equipment manufacturer to publish equipment performance on its company Web site at **www.kaesercompressors.com/PRODUCTS/CAGIshtL.php**. This is significant because, for the first time, industrial facility engineers and procurement officials have ready access to specific model information in the standardized CAGI format. Web-based access to model-specific standardized data allows consumers to easily and reliably compare the performance of compressor models prior to purchase, something that was previously very difficult. As additional companies follow Kaeser's lead, evaluating the performance of compressed air equipment prior to purchase will become even easier. ●

Letters to the Editor

Energy Matters welcomes your typewritten letters and e-mails. Please include your full name, address, organization, and phone number, and limit comments to 200 words. Address correspondence to:

Michelle Mallory, Letters to the Editor
NREL, MS 1609
1617 Cole Blvd.
Golden, CO 80401
E-mail: michelle_sosa-mallory@nrel.gov

We publish letters of interest to readers on related topics, comments, or criticisms/corrections of a technical nature. Preference is given to articles that appeared in the previous two issues. Letters may be edited for length, clarity, and style. ●

Editor's Note

A Mil by Any Other Name

In the Figure 2 caption of Don Casada's Performance Optimization Tips (page 8, Fall 2001 issue) we printed "40-mil" as "40-millimeter" in reference to the gap separating current transducer jaws. The figure illustrates that even a slight gap of 40 mil can cause a considerable error in the indicated current. Our apologies to Don for the error. ●

Energy Matters Extra

Read more about "smart systems" and how they could benefit your company in Energy Matters Extra. Access more information about the OIT Showcase at Augusta Newsprint and OIT's Forest Products Industry of the Future program. Learn more about combustion control strategies, and how OIT is helping to improve heat-delivery processes for greater efficiency, productivity, and quality. Plus, link to more on the Motor Decisions Matter campaign, and find out about publications, tools, and training information from OIT's BestPractices Motors program. Order the new OIT Decision Tools for Industry CD, which includes four powerful system assessment tools. And finally, link to the Hydraulic Institute for more on the pump Life Cycle Cost analysis tool.

Log on to Energy Matters Extra at **www.oit.doe.gov/bestpractices/energymatters/emextra**. ●

Coming Events

Energy & Environmental Summit 2002

- February 21-22, 2002, San Diego, CA

For more information, contact Jack Flynn at 619-298-5554, or e-mail info@ees2002.com

Paper Summit 2002 and TAPPI Energy Results Showcase

- March 3-6, 2002, Atlanta, GA

The event will be held in conjunction with OIT's Showcase Demonstration at Augusta Newsprint (see below). For more information about the Paper Summit, contact Erin Layton at 212-268-4160 ext. 125 or e-mail elayton@paperloop.com. Visit the Paper Summit Web site at **www.papersummit.net**.

OIT Showcase Demonstration at Augusta Newsprint

- March 6-7, 2002, Augusta, GA

For more information, see the special supplement in this issue of *Energy Matters,* and visit the Web site at **www.energetics.com/augustashowcase**.

Annual Distributed Generation and On-site Power Conference

- March 11-12, 2002, Atlanta, GA

For more information, call 508-427-9470, or e-mail gesi@mediaone.net.

TAPPI Allied Partner Event

- April 17, 2002, Delaware Valley, DE

For more information, call Chris Cockrill at 816-873-3299, or e-mail Chris.Cockrill@ee.doe.gov.

Process Heating Workshop

- April 19, 2002, Houston, TX

For more information, call Bob Gemmer at 202-586-5885, or e-mail Bob.Gemmer@ee.doe.gov.

To keep up-to-date on OIT training and other events, check the calendar regularly on Energy Matters Extra at **www.oit.doe.gov/bestpractices/energymatters/emextra**.

BestPractices

The Office of Industrial Technologies (OIT) BestPractices initiative and its *Energy Matters* newsletter introduce industrial end users to emerging technologies and well-proven, cost-saving opportunities in motor, steam, compressed air, and other plant-wide systems. For overview information and to keep current on what is happening office wide, check out the newsletter—The OIT Times—at **www.oit.doe.gov/oit-times**.

Information Clearinghouse

Do you have questions about using energy-efficient process and utility systems in your industrial facility? Call the OIT Information Clearinghouse for answers, Monday through Friday 9:00 a.m. to 8:00 p.m. (EST).

HOTLINE: 800-862-2086

Fax: 360-586-8303, or access our homepage at www.oit.doe.gov/clearinghouse.

DOE Regional Office Representatives

- David Godfrey, Atlanta, GA, 404-562-0568
- Scott Hutchins, Boston, MA, 617-565-9765
- Brian Olsen, Chicago, IL, 312-886-8579
- Jack Jenkins, Denver, CO, 303-275-4824
- Chris Cockrill, Seattle, WA, 816-873-3299
- Joseph Barrett, Philadelphia, PA, 215-656-6957

This document was produced for the Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy (DOE) by the National Renewable Energy Laboratory, a DOE national laboratory.
DOE/GO-102002-1501 • Winter 2002

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National Renewable Energy Laboratory
1617 Cole Boulevard
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